## REMARKS

Claims 1 to 60 were pending when last examined. Applicant has amended claims 1, 3 to 7, 9, 10, 12 to 17, 22, 23, 25, 26, 28 to 35, 37 to 39, 41 to 43, 45, 47, 48, 50 to 54, 57 to 60. Applicant has canceled claims 8, 11, 36, 44, 46, 55, and 56. Applicant has added claims 61 to 63. Claims 1 to 7, 9, 10, 12 to 35, 37 to 43, 45, 47 to 54, and 57 to 63 remain pending.

Specification and Drawings

Applicant has amended the Specification to remove URLs and Appendices A, B, and C. Applicant has amended the Specification and the Drawings to remove typographical errors and for consistency with each other.

§ 102 Rejections

The Examiner rejected claims 1 to 11, 26 to 37, 41 to 44, and 46 to 56 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,963,675 ("van der Wal et al.").

Claims 1 to 11

Applicant has amended claim 1, which now recites:

> 1. A method for stabilizing motion in a sequence of frames, comprising:
>
> retrieving a group of pictures from the sequence of frames, the group of pictures comprising more than two images;
>
> identifying a plurality of features in a first frame in the group of pictures;
>
> determining tracked positions for the features in remaining frames in the group of pictures based on the features in the first frame;
>
> after said determining tracked positions, determining ideal positions for the features in the remaining frames in the group of pictures based on the tracked positions, said determining ideal positions comprises, for each feature:
>
> plotting its position from the first frame and its tracked positions from the remaining frames in an X, Y coordinate graph; and
>
> drawing a motion trajectory that connects a first plotted position from the first frame to a last plotted position from a last frame in the group of pictures, wherein the ideal positions are located on the motion trajectory;

identifying transformation information based on the tracked positions and the ideal positions;

transforming the remaining frames in the group of pictures by adjusting pixels in the remaining frames based on the transformation information; and

repeating for remaining groups of pictures in the sequence of frames.

Amended claim 1 (emphasis added).

Claim 1 recites a method that processes groups of pictures in a video, wherein each group of picture (GOP) has more than two frames (e.g., 50 to 90 frames). Specifically, the claimed method determines positions of features across frames in a GOP, plots the detected positions of the features in a graph, draws a motion trajectory from positions from a first frame to positions from a last frame in the GOP, determines ideal positions of the features on the motion trajectory, and then warps the frames in the group of pictures based on the detected and the ideal positions of the features.

On the other hand, van der Wal et al. discloses a method that processes two consecutive frames in a video. Specifically, the method of van der Wal et al. correlates a current frame against a previous frame and then warps the current frame to match the previous frame.

> FIG. 3 is a flow chart illustrating the stabilization method for stabilizing a video image signal. At step 300, the method determines the image motion between the current frame F(t) and a previous frame F(t-1). Then, at step 310, the alignment parameters Cz are generated to align the current image F(t) to the reference frame, or to an image position at which unwanted image motion is removed. At step 320, the current image is re-aligned, i.e.--warped, according to the alignment parameters Cz. The stabilization method of FIG. 3 is illustrated in FIG. 4.
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> As shown in FIG. 4, a set of image correlations are performed in a hierarchical fashion to determine the amount of image motion that has occurred between the current frame F(t) and the previous frame F(t-1). To determine the amount of image motion, an image pyramid is generated from the current frame F(t). For example, the Laplacian pyramid Lz(t-1) to Lz(t-1), for example L.sub.0 (t-1) to L.sub.4 (t-1), is generated for the previous frame F(t-1) and the Laplacian pyramid Lz(t) to Lz(t), for example L.sub.0 (t) to L.sub.4 (x), is generated for the current frame F(t). The correlation between the current frame F(t) and the previous frame F(t-1) are performed using a sixty four pixel value by sixty four pixel value region of the frames.

van der Wal et al., col. 6, line 54 to col. 7, line 9. Applicant notes that Figs. 2(a), 2(b), 2(c), and 2(d) of van der Wal et al. only illustrate the results of applying the above described method (i.e.,

correlating two consecutive frames) to remove all motions or just the fast motion from four frames of a video.

> .... Image stabilization can be achieved by determining the image motion between consecutive image frames, and then compensating for this image motion by warping, i.e.--aligning, the current frame towards a previous frame so that its image aligns with the image of that previous frame. An example of several consecutive frames of an video image signal is shown in FIG. 2(a) where t indicates an instant in time. The video image signal includes a sequence of four video frames F(t), F(t+1), F(t+2), and F(t+3), where there is an apparent random motion of the image 200 in the four frames.
>
> FIG. 2(b) shows the four frames F(t), F(t+1), F(t+2), and F(t+3) superimposed to illustrate the amount of image motion among the four frames. FIG. 2(c) illustrates the four frames F(t), F(t+1), F(t+2), and F(t+3) after image stabilization according to the first method. The subsequent image frames F(t+1), F(t+2), and F(t+3) are aligned to the frame F(t). FIG. 2(d) illustrates the four frames F(t), F(t+1), F(t+2), and F(t+3) after image stabilization according to a second method where image stabilization is implemented by "smoothing" the image motion. There is a general motion of the image to the right in FIG. 2(d).

van der Wal et al., col. 6, lines 31 to 43 (emphasis added). As the methods of van der Wal et al. disclose correlating two consecutive frames, Figs. 2(a) to 2(d) of van der Wal et al. cannot illustrate plotting detected positions of features from a GOP in a graph, drawing a motion trajectory from positions from a first frame to positions from a last frame in the GOP, determining ideal positions of the features on the motion trajectory, and then warping the frames in the group of pictures based on the detected and the ideal positions of the features. Accordingly, amended claim 1 is patentable over van der Wal et al.

Claims 2 to 7, 9, and 10 depend from amended claim 1 and are patentable over van der Wal et al. for at least the same reasons as amended claim 1. Furthermore, various dependent claims are further patentable over van der Wal et al. for the following reasons.

Amended claim 6 recites two ways of determining estimated positions of features in a second frame based the camera motion. Specifically, amended claim 6 recites a first way of determining the estimated positions by identifying features in the second frame and then matching those features to features in the first frame when the camera motion is fast. Amended claim 6 also recites a second way of determining the estimated positions by globally tracking features in the second frame based on positions of the features in the first frame when the camera motion is slow. While van der Wal et

al. discloses one mode for removing all motions and another mode for removing fast motion, it does not disclose two different ways to correlate the frames based on the camera motion.

Amended claim 10 recites "a non-linear motion trajectory." Applicant notes that Figs. 2(b) and 2(c) of van der Wal et al. cannot show a non-linear motion trajectory. As discussed above, van der Wal et al. removes motion by correlating two consecutive frames without determining a motion trajectory that spans a GOP having more than two frames. Therefore, van der Wal et al. cannot disclose determining a motion trajectory that spans a GOP, let alone a non-linear motion trajectory.

Applicant has canceled claims 8 and 11, thereby rendering their rejections moot.

Claims 26 to 37

Applicant has amended claim 26 with similar limitations as amended claim 1. Accordingly, amended claim 26 is patentable over van der Wal et al. for at least the same reasons as amended claim 1.

Claims 27 to 35 and 37 depend from amended claim 26 and are patentable over van der Wal et al. for at least the same reasons as amended claim 26.

Applicant has canceled claim 36, thereby rendering its rejection moot.

Claims 41 to 44, 46, and 47

Applicant has amended claim 41 with similar limitations as amended claim 1. Accordingly, amended claim 41 is patentable over van der Wal et al. for at least the same reasons as amended claim 1.

Claims 42, 43, and 47 depend from amended claim 41 and are patentable over van der Wal et al. for at least the same reasons as amended claim 41.

Applicant has canceled claims 44 and 46, thereby rendering their rejections moot.

Claims 48 to 56

Applicant has amended claim 48 with similar limitations as amended claim 1. Accordingly, amended claim 48 is patentable over van der Wal et al. for at least the same reasons as amended claim 1.

Claims 49 to 54 depend from amended claim 48 and are patentable over van der Wal et al. for at least the same reasons as amended claim 48.

Applicant has canceled claims 55 and 56, thereby rendering their rejections moot.

§ 103 Rejections

The Examiner rejected claims 12, 20, 21, 24, 25 under 35 U.S.C. §103(a) as being unpatentable over van der Wal et al. (hereafter "van der Wal et al. 5"). The Examiner rejected claims 13, 14, 45, and 57 to 60 under 35 U.S.C. §103(a) as being unpatentable over the combination of van der Wal et al. 5 and U.S. Patent No. 6,459,822 ("Hathaway et al."). The Examiner rejected claims 18, 19, and 40 under 35 U.S.C. §103(a) as being unpatentable over the combination of van der Wal et al. 5 and U.S. Patent No. 6,636,220 ("Szeliski et al.") The examiner rejected claims 15, 21, and 37 under 35 U.S.C. §103(a) as being unpatentable over the combination of van der Wal et al. 5 and U.S. Patent No. 6,567,574 ("van der Wal et al. 6"). The Examiner rejected claims 16, 17, 22, 23, 38, and 39 under 35 U.S.C. §103(a) as being unpatentable over the combination of van der Wal et al. 5, van der Wal et al. 6, and Hathaway et al.

Claims 12 to 19

Claims 12 to 19 depend from amended claim 1 and are patentable over the cited references for at least the same reasons as claim 1.

Claim 20 to 25

Amended claim 20 recites similar limitations as amended claim 1. Specifically, amended claim 20 recites plotting detected positions of points of interest across three frames in a graph, connecting a first plotted position from a first frame to a last plotted position from a third frame, and detecting ideal positions located on the connection. As discussed above, van der Wal et al. only discloses correlating motion between two consecutive frames and does not disclose determining ideal positions across more than two frames. Accordingly, amended claim 20 is patentable over the cited references for at least the same reasons that amended claim 1 is patentable over van der Wal et al.

Claims 21 to 25 depend from amended claim 20 and are patentable over the cited references for at least the same reasons as amended claim 20.

Claims 37 to 40

Claims 37 to 40 depend from amended claims 26 and are patentable over the cited references for at least the same reasons as amended claim 26.

Claim 45

Claim 45 depends from amended claim 41 and is patentable over the cited references for at least the same reasons as amended claim 41.

Claims 57 to 60

Claims 57 to 60 depend from amended claim 48 and are patentable over the cited references for at least the same reasons as amended claim 48.

New Claims

New claims 61 to 63 depend from amended claim 1 and are patentable over the cited references for at least the same reasons as amended claim 1.

Summary

In summary, claims 1 to 60 were pending in the above-identified application when last examined. Applicant has amended claims 1, 3 to 7, 9, 10, 12 to 17, 22, 23, 25, 26, 28 to 35, 37 to 39, 41 to 43, 45, 47, 48, 50 to 54, 57 to 60. Applicant has canceled claims 8, 11, 36, 44, 46, 55, and 56. Applicant has added claims 61 to 63. For the above reasons, Applicant respectfully requests the allowance of claims 1 to 7, 9, 10, 12 to 35, 37 to 43, 45, 47 to 54, and 57 to 63. Should the Examiner have any questions, please call the undersigned at (408) 382-0480.

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I hereby certify that this paper is being electronically transmitted to the U.S. Patent and Trademark Office using EFS-Web on the date shown below.

/David C Hsia/ Signature

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Respectfully submitted,

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